



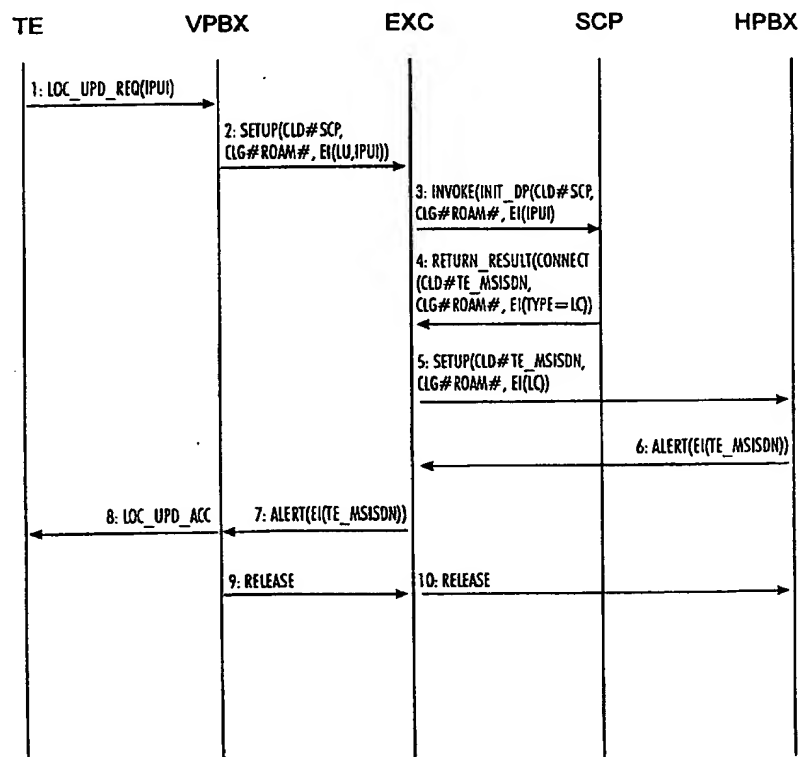
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 7/26		A1	(11) International Publication Number: WO 98/12886
			(43) International Publication Date: 26 March 1998 (26.03.98)
(21) International Application Number: PCT/FI97/00559 (22) International Filing Date: 18 September 1997 (18.09.97) (30) Priority Data: 963722 19 September 1996 (19.09.96) FI (71) Applicant (for all designated States except US): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): LAHTINEN, Lauri [FI/FI]; Kurkijoentie 7 B, FIN-02140 Espoo (FI). (74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>	

(54) Title: LOCATION MANAGEMENT OF A WIRELESS TERMINAL

(57) Abstract

Location data of a subscriber terminal (TE) are maintained by means of intelligent network technique. Signalling between a telephone exchange (EXC) and a PBX is supplemented with extra information including the information on the location of the subscriber TE. A roaming number ROAM# is allocated to a TE moving into the area of a Visited PBX (VPBX). Call setup protocol between the PBX and the EXC is supplemented with an extra packet (EI) supporting the subscriber mobility in such a way that the information on the subscriber's location can be transmitted to a Service Control Point (SCP) of the intelligent network. In connection with location updating, the VPBX informs the intelligent network (SCP) that the TE tries to register to the area of the VPBX. The intelligent network (SCP) checks whether said subscriber has the right to use the services of the VPBX. In case of a call to the TE, the EXC asks the intelligent network (SCP) for the location information of the TE on the basis of the subscriber number of the TE. Subsequently, the EXC establishes a connection with the PBX indicated by the location information, which PBX sets up a call to said TE.



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LOCATION MANAGEMENT OF A WIRELESS TERMINAL

FIELD OF THE INVENTION

The invention relates to supporting the mobility of wireless terminals, such as DECT telephones, in a telephone network.

BACKGROUND OF THE INVENTION

With reference to Figure 1, wireless terminals, such as DECT telephones, as described in ETSI Standard 300 175 Radio Equipment and System: Digital Cordless European Telephone, Common Interface, Sections 1 to 9, can be connected to a Public Integrated Services Network PISN. The DECT System comprises a base station FP (Fixed Part), usually connected to the PISN via a Private Branch Exchange PBX. There are three main types of base stations FP: a home base station or a base station to be connected to an office PBX and so-called telepoint base stations. In a conventional wired telephone network, e.g. signalling protocols DPNSS and DSS.1 are used, which are described in the CCITT (now ITU) Specification: "DSS.1, Q.930 to Q.940, 1989, Digital Subscriber Signalling System No. 1, Network Layer, User-Network Management". These signalling protocols support the mobility of the subscriber very poorly or not at all.

To support the subscriber mobility, services of a PBX network can be supplemented with Intelligent Network (IN) technique determined e.g. in the specifications of ITU Q.1200 series. By IN technique, it is possible to combine telecommunications networks of different types, such as the PISN and cellular mobile systems, e.g. GSM and NMT, not shown separately in Figure 1. The principle of IN technique is that the signalling needed for establishing a speech connection takes place controlled by the IN, but the actual speech connection is switched by known functions of the communications network in question.

One of the services provided by the IN is Follow Me Destination (FMD) call transfer. By means of this service, the subscriber may control his incoming calls to a desired number, which can be e.g. an extension number of the PBX network or a mobile network number. In Figure 1, for example, a Terminal Equipment TE1 user moving from a first DECT system DECT1 to a second system DECT2 may order a call transfer to an extension number of this second system.

The main problem with the solution described is that a call transfer requires activity and carefulness of the subscriber. In solutions of the prior art, the subscriber has to know the extension number to which calls shall be transferred and to remember to give this information to the operator.

5

SUMMARY OF THE INVENTION

The object of the invention is to develop a method and an equipment implementing the method in such a way that the above problems with the subscriber mobility and location management can be solved. The objects of
10 the invention are achieved by a method and a system, which are characterized in what is set forth in the independent claims. Preferred embodiments of the invention appear from the dependent claims.

The invention is based on the fact that subscriber location data are maintained by means of IN technique. Signalling between a telephone ex-
15 change and a PBX is supplemented with extra information on the location of the subscriber terminal.

An advantage of the method and system of the invention is an improved support to the mobility of the subscriber. The subscriber does not need to determine separately the extension number to which he wishes to transfer
20 his calls. It is enough that the subscriber starts his phone in the area of a new PBX. The invention does not require changes in existing terminals. The invention can also be applied to double-mode terminals, such as GSM/DECT telephones, which means that the invention saves radio resources, since the greatest possible part of the signalling takes place via a wired telephone net-
25 work.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

30 Figure 1 shows such parts of a known telecommunications system which are substantial for the understanding of the invention;

Figures 2A and 2B show a location updating according to the invention in a DECT system; and

Figure 3A shows signalling in case of a mobile terminated call; and
35 Figure 3B shows signalling in case of an internal call in a PBX.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Figure 1, the invention suggests that the functionality of a PBX is supplemented in a way which is to some extent analogous with the home and/or visitors location register of mobile systems. A home PBX (HPBX) is allocated to each subscriber of a wireless system. In this application, a PBX other than HPBX is called a Visited PBX (VPBX). Each PBX comprises both HPBX and VPBX functionality. Within the scope of this application, a transmitting exchange EXC is any exchange via which the PBXs are connected to the PISN and/or mobile networks. The EXC is supposed 1) to have an interface to the PBXs for a speech connection, 2) to support an interface to a Service Switching Point SSP of the IN for a signalling connection and 3) to support the INAP signalling protocol extended for this purpose (INAP extensions).

According to the invention, a roaming number ROAM# is allocated to a subscriber moving to the area of a VPBX. In the numbering plan, a fixed area can be reserved from the number space of said PBX for the roaming numbers. In this way, it is possible to avoid consuming the numbers of the PISN.

A functionality supporting subscriber mobility can be implemented for instance by a suitable addition to the conventional call setup protocol between the PBX and the EXC. Messages used for call setup may include an extra packet EI (Extra Information). The EI packet can be coded in different ways in different signalling protocols. In case of the DSS.1 protocol of the example, suitable information elements are e.g. FACILITY and USER_TO_USER. A separate specific field can also be defined for this purpose. The extra packet EI is transparent to the EXC (the exchange does not react to it). The purpose of the EI packet is to support the subscriber's mobility in such a way that an information on the subscriber's location can be transmitted via the SSP of the IN to a Service Control Point SCP of the IN. On the other hand, the SCP maintains data in a Service Data Point SDP. By means of the extra packet, information on subscriber identification or authentication, for instance, can be transferred.

A logic interface between the PBX and the IN - especially its SCP - comprises two functionalities according to the invention: location updating and location cancellation.

At Location Updating LU, the VPBX informs the SCP of the IN that the terminal TE tries to register to the area of a new PBX. Upon receiving this information, the SCP checks from the SDP the subscriber data and especially whether said subscriber has the right to use the services of the new VPBX.

- 5 At Location Cancellation LC, the SCP removes from the SDP the information on that the terminal TE is in the area of the VPBX.

Figure 2A shows a possible signalling when a terminal registers to the area of a VPBX. To keep the figure illustrative, only steps essential for the invention are shown. In this application, reference numerals 2A-1, 2B-1, etc.
10 signify corresponding steps in Figures 2A, 2B, etc.

In step 2A-1, the terminal TE sends to the VPBX a Location Update Request including the identity of the TE or its subscriber. It is assumed initially that the identity is e.g. an International Portable User Identity IPUI. The VPBX notices that said terminal is not registered to this PBX and that the HPBX of
15 the terminal is other than the VPBX. Therefore, a calling subscriber's roaming number (CLG#ROAM#, Calling Number Roaming Number) is allocated to the terminal. The roaming numbers are preferably reserved from the number space of the PBX. In this way, it is possible to avoid consuming the numbers of the PISN.

- 20 In step 2A-2, the PBX sends the EXC a call setup request SETUP including, in addition to the number of the called subscriber, i.e. subscriber B, also the roaming number allocated in step 2A-1 and the above-mentioned extra packet EI. The EI packet includes the information on that the type of the task is location updating LU of a terminal/subscriber whose identity is IPUI.
25 The EXC performs a number analysis of the called subscriber number and notices that an IN service request has to be made for location updating of the terminal TE in the SDP of the intelligent network.

In step 2A-3, the EXC sends a service request INVOKE to the SCP of the IN. This joins together the identity of the terminal or its subscriber, such
30 as the IPUI number, and the subscriber number of the terminal, such as the TE_MSISDN number, which is returned to the EXC in a Connect message in step 2A-4. In step 2A-5, the EXC sends the HPBX a location cancellation message LC, which can be for instance a call setup request SETUP supplemented with an extra packet EI according to the invention. The EI packet in-
35 cludes in this step an information on that the subscriber location of the terminal in the area of the HPBX is cancelled. In step 2A-6, the HPBX sends an ALERT

message to the EXC. In step 2A-7, the EXC sends a corresponding ALERT message to the VPBX, which in step 2A-8 acknowledges the location updating of the terminal TE. In steps 2A-9 and 2A-10, the signalling connections are cancelled.

- 5 If an International Portable Equipment Identity IPEI is used instead of the subscriber's IPUI, the signalling functions as described above, except that the location data of the physical terminal TE are maintained, instead of those of the subscriber. By implementing the location management of the invention by means of the signalling relating to a call setup, the existing signalling and the SCP interface can be used without any great changes.

10 If the TE moves from the area of a first VPBX into the area of a second VPBX, the signalling takes place as above, except that the location cancellation LC is sent to that VPBX where the subscriber's IPUI (or the IPEI of the terminal) last was updated.

- 15 Figure 2B shows the signalling in case if the TE returns to the area of its HPBX. The signalling corresponds to the steps described in connection with Figure 2A, but the tasks of the HPBX and VPBX are inverse during the steps 2B-1 to 2B-9. The steps 2A-n and 2B-n can be indicated by a common marking 2x-n. The location of the TE is updated from the VPBX to the HPBX.

- 20 With reference to Figure 3A, it is assumed that the terminal TE receives a call, when it is within the area of a VPBX. In case of an incoming call, the signalling takes place as follows. In step 3A-1, a call comes to an EXC from another exchange EXC2 not shown, which can be an exchange of the PISN or equally well a mobile network exchange. In step 3A-2, the EXC sends
25 the SCP of the IN a service request INVOKE including the TE_MSISDN number of the terminal. In step 3A-3 the SCP returns to the EXC a roaming number CLD#ROAM# allocated to the terminal. In step 3A-4, the EXC concludes from the roaming number that the TE exists in the area of the VPBX and sends said PBX a call setup request. The steps 3A-5 to 3A-10 correspond to
30 conventional call setup. In step 3A-5, the terminal TE is paged and, in step 3A-6, it responds to the paging, etc. In step 3A-10, the EXC sends an Access_Complete Message to the other exchange EXC2.

- 35 Figure 3B shows signalling in case of an internal call in an HPBX of a DECT system. It is assumed that subscriber A is TE1 and subscriber B is TE2, respectively. The signalling takes place in the same way as in a conventional DECT call. No service request to the SCP of the IN is needed, because

the HPBX notices in step 3B-2 that the subscriber B is in the area of the same PBX and can start paging according to the prior art. If the subscriber B were in the area of a VPBX, the signalling would take place in the same way as in Figure 3A, but the call would be started from the terminal TE1 of the subscriber A, instead of starting from the EXC2.

A physical implementation of the invention presupposes that location updating and call setup messages according to the prior art are supplemented with extra information elements of the invention. This is implemented in the easiest way by changes in software. To be precise, the arrangement of the invention comprises the following changes:

- a PBX comprises means for indicating location information for a terminal TE of a wireless network;
- the PBX comprises means for adding the location information and the identity (IPUI/IPEI) of the TE to a call setup message SETUP;
- an EXC comprises means for sending the location information and the identity of the TE to a node SCP of an IN in connection with a service request INVOKE;
- the node SCP of the IN comprises means for adding the location information and the identity of the TE to the ISDN number of the TE.

The invention has been described by way of example in connection with the DECT system and assuming that DSS.1 signalling is used between the PBXs and the exchanges. On the basis of the above description, it is easy for one skilled in the art to apply the invention to other wireless telephone systems as well. It is also clear that the invention is equally suitable for location management of all kinds of mobile terminals, not only of a telephone. The invention and its embodiments are thus not restricted to the above examples, but they can vary within the scope of the claims.

CLAIMS

1. Method for location updating of a wireless terminal (TE) in a communications system comprising a number of Private Branch Exchanges (HPBX, VPBX) and at least one telephone exchange (EXC) and being connected to a Public Integrated Services Network (PISN) and an intelligent network;

in which method the terminal (TE) sends (2A-1, 2B-1) in connection with a call setup a location updating message to a PBX and the PBX sends (2A-2, 2B-2) a call setup message to the exchange (EXC);

10 **characterized** in that, additionally in the method,

- the PBX adds (2A-2, 2B-2) the location information and the identity of the terminal (TE) to the call setup message;

- the EXC sends a node (SCP) of the intelligent network a service request (2A-3, 2B-3), including the location information and the identity of the

15 terminal (TE); and

- the node (SCP) of the intelligent network adds the location information of the terminal (TE) to the subscriber number, preferably to the MSISDN number, of said terminal (TE).

2. Method according to claim 1, **characterized** in that in
20 case of an incoming call (3A-1) to the terminal (TE):

- the exchange (EXC) sends (3A-2) the node (SCP) of the intelligent network a service request comprising the subscriber number, preferably the MSISDN number, of the terminal (TE);

25 - the node (SCP) of the intelligent network returns (3A-3) the location information of the terminal (TE) to the exchange (EXC);

- the exchange (EXC) establishes (3A-4) a connection with the PBX indicated by the location information of the terminal (TE), which PBX sets up (3A-5) a call with said terminal (TE).

3. Method according to claim 1 or 2, **characterized** in that
30 at least one Home Private Branch Exchange (HPBX) is allocated to each terminal (TE), which HPBX notices in case of an internal call that both the calling and the called subscriber are in the area of the same PBX, and in this case the HPBX sets up a call without any service request to the intelligent network.

4. Method according to any one of the claims 1 to 3, **characterized**
35 in that the PBX (HPBX, VPBX) reserves for the terminal (TE) a

roaming number (CLG#ROAM#) used as location information of the terminal (TE).

5 5. Method according to claim 4, **characterized** in that a fixed area from a number space of the PBX (HPBX, VPBX) in question is reserved for roaming numbers (CLG#ROAM#) in the numbering plan.

6. Method according to any one of the claims 1 to 5, **characterized** in that the terminal (TE) is a terminal of the DECT system and the identity of the terminal (TE) is IPUI or IPEI.

10 7. Method according to claim 6, **characterized** in that the method uses DSS.1 signalling protocol and the location information is positioned in a FACILITY or USER_TO_USER information element.

8. Private Branch Exchange (PBX), comprising means for connection to a Service Switching Point (SSP) of an intelligent network and to base stations (DECT-FP) of a telephone system supporting wireless terminals (TE);

15 **characterized** in that the PBX additionally comprises

- means for indicating location information for a subscriber (TE) of a wireless network; and

20 - means for sending the location information and the identity of the terminal (TE) to an exchange (EXC) in connection with a location updating performed by the terminal (TE).

9. Private Branch Exchange (PBX) according to claim 8, **characterized** in that the location information of a terminal (TE) is a roaming number (CLG#ROAM#), which is preferably reserved from the number space of said PBX.

25 10. Arrangement for location updating of a wireless terminal (TE) in a communications system, the arrangement comprising a number of PBXs (HPBX, VPBX) and being in connection with a Public Integrated Services Network (PISN) and an intelligent network;

30 in which arrangement the terminal (TE) comprises means for sending a location updating message (LOC_UPD_REQ) in connection with a call setup to a PBX and the PBX comprises means for sending a call setup message (SETUP) to an exchange (EXC);

characterized in that additionally

35 - the PBX comprises means for allocating location information to the terminal (TE) of the wireless network;

- the PBX comprises means for adding the location information and the identity of the terminal (TE) to the call setup message (SETUP);

- the exchange (EXC) comprises means for sending the location information and the identity of the terminal (TE) to a node (SCP) of the intelligent network in connection with a service request (INVOKE);

- the node (SCP) of the intelligent network comprises means for adding the location information and the identity of the terminal (TE) to the subscriber number, such as a MSISDN number, of the terminal (TE).

11. Arrangement according to claim 10, **characterized** in that the location information of the terminal (TE) is a roaming number (CLG#ROAM#) allocated by the PBX.

Fig. 1

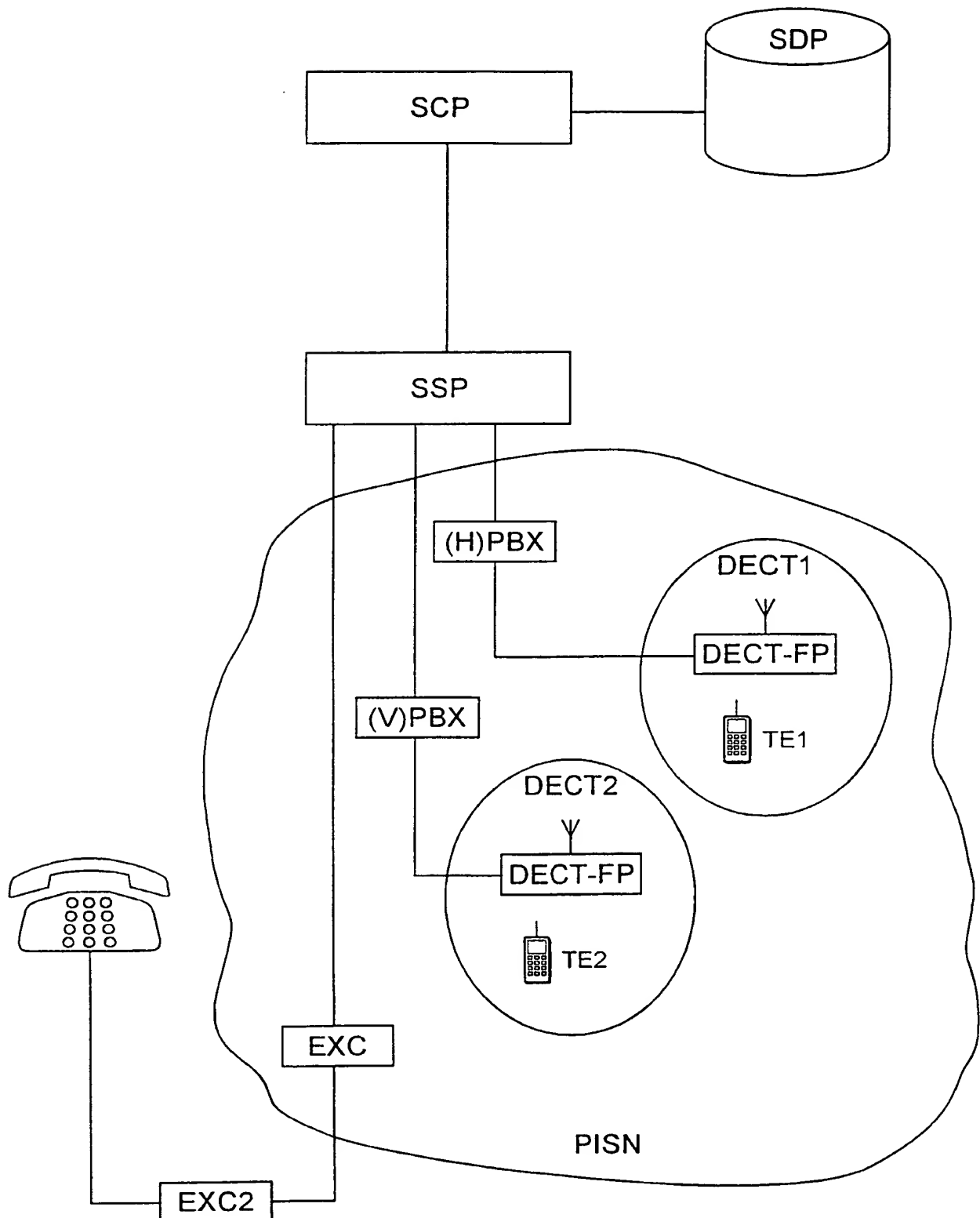


Fig. 2A

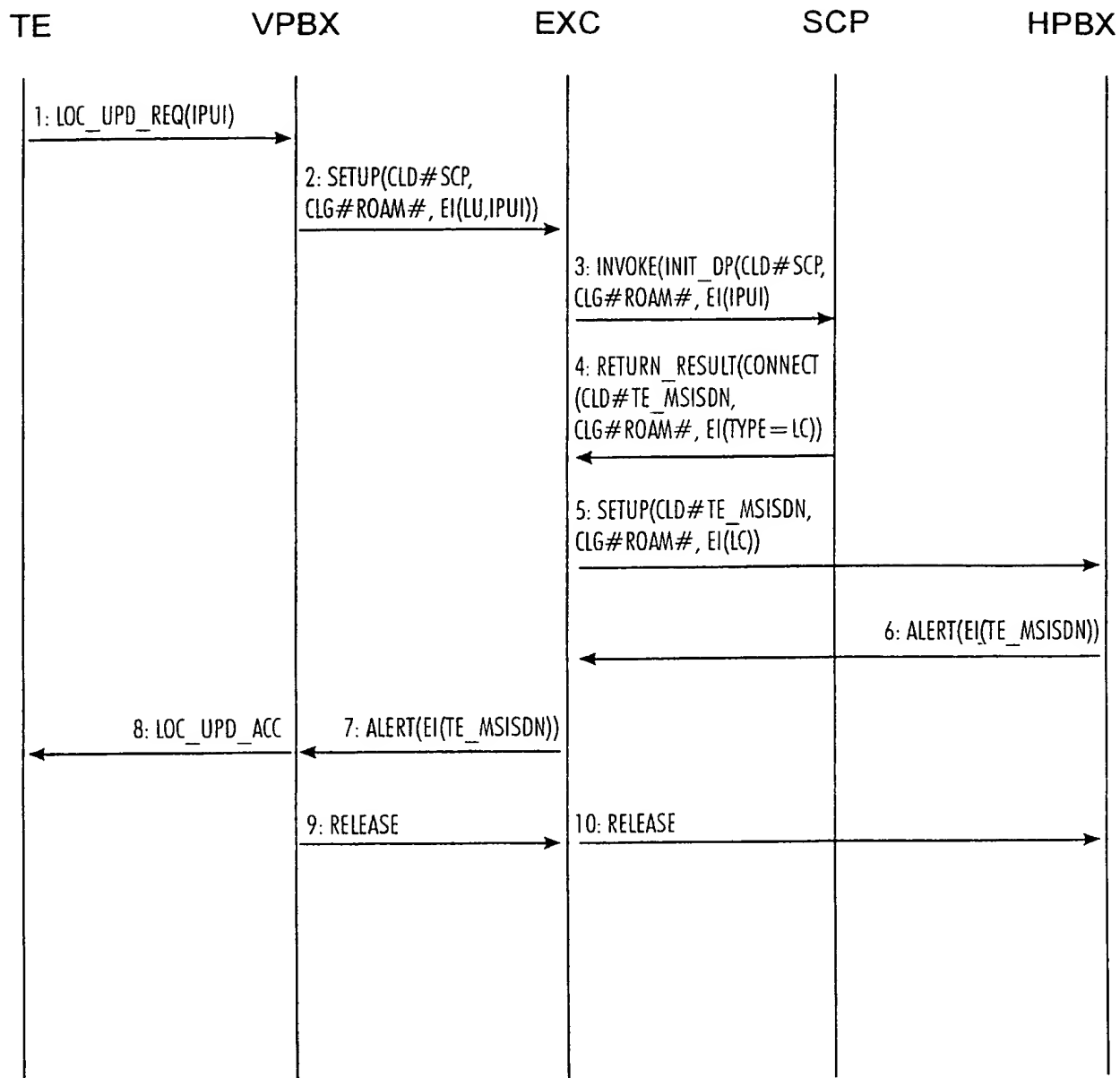


Fig. 2B

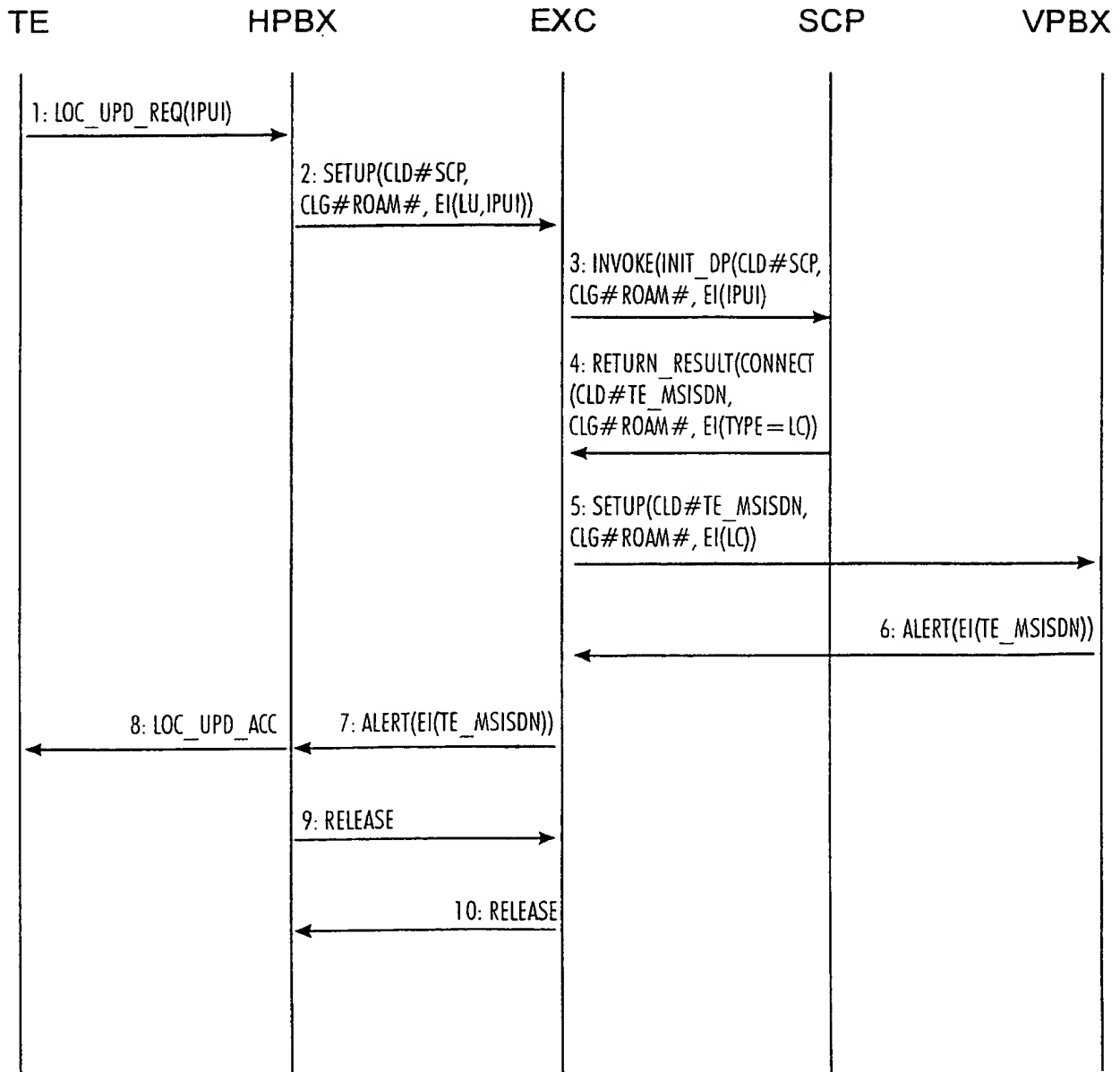


Fig. 3A

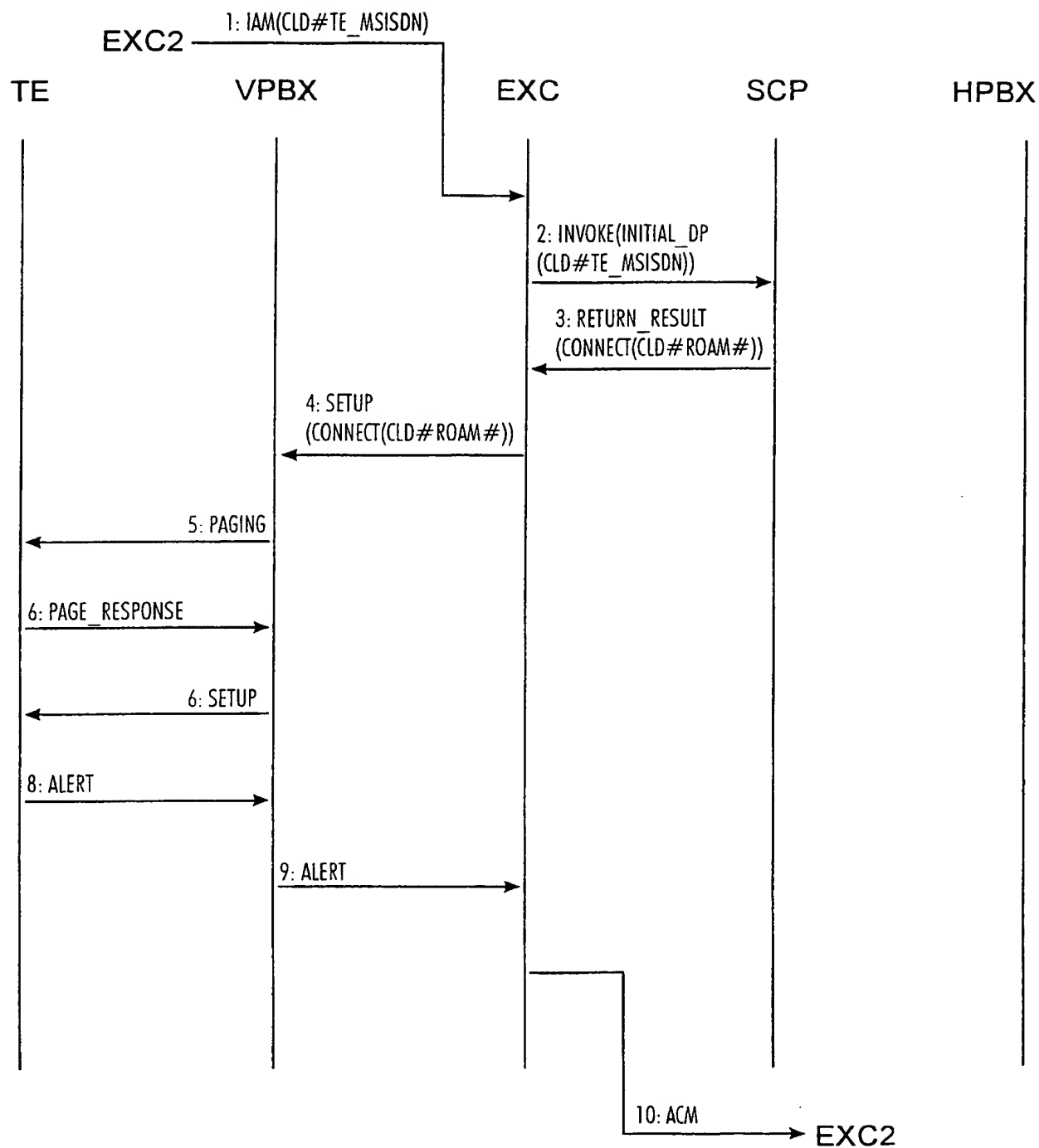
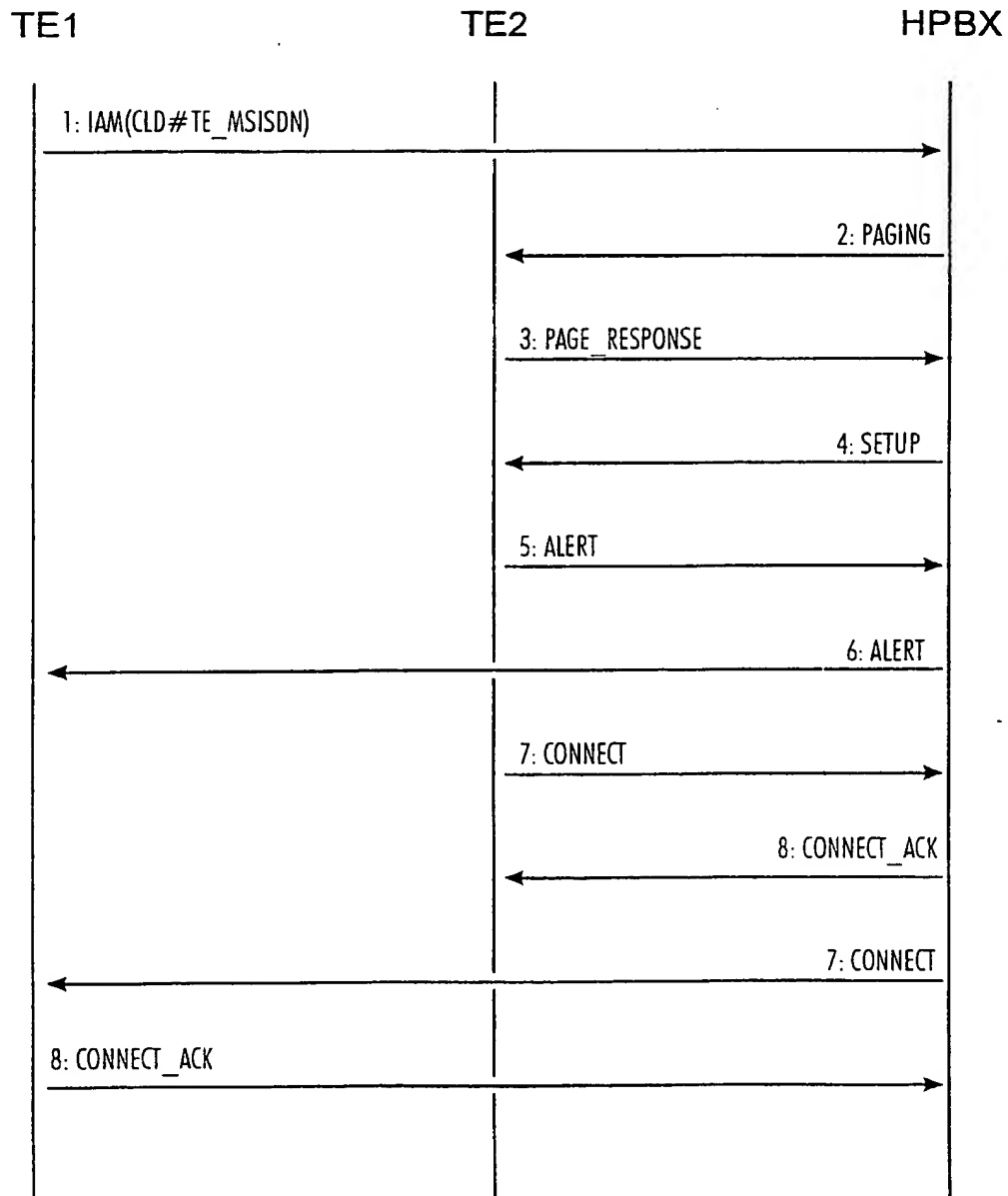


Fig. 3B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00559

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9325050 A1 (NOKIA TELECOMMUNICATIONS OY), 9 December 1993 (09.12.93), page 1, line 1 - page 2, line 15; page 8, line 17 - page 12, line 13	8
A	--	1-7,9-11
X	WO 9618273 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 13 June 1996 (13.06.96), page 10, line 11 - page 13, line 3	8
A	--	1-7,9-11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

19 February 1998

Date of mailing of the international search report

20 -02- 1998

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00559

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9533348 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 7 December 1995 (07.12.95), page 10, line 10 - line 18; page 12, line 8 - page 13, line 15; page 15, line 27 - page 16, line 14, page 17, line 11 - line 25, page 19, line 9 - line 21 -----	1-11

INTERNATIONAL SEARCH REPORT
Information on patent family members

03/02/98

International application No.

PCT/FI 97/00559

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9325050 A1	09/12/93	AU 661775 B AU 4071693 A EP 0610453 A FI 95758 B,C JP 6509924 T NO 940244 A US 5561840 A	03/08/95 30/12/93 17/08/94 30/11/95 02/11/94 24/03/94 01/10/96
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WO 9533348 A1	07/12/95	AU 2686495 A CA 2190257 A EP 0763308 A FI 964774 A SE 9401879 A	21/12/95 07/12/95 19/03/97 29/11/96 01/12/95

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 43215/PCT/nu	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI97/00559	International filing date (day/month/year) 18.09.1997	Priority date (day/month/year) 19.09.1996
International Patent Classification (IPC) or national classification and IPC ₆ H 04 Q 7/26		
Applicant Nokia Telecommunications Oy et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 14.04.1998	Date of completion of this report 13.01.1999
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Björn Edlund Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI97/00559

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

- ☐ the international application as originally filed.
- ☒ the description, pages 1 - 6, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____,
 pages _____, filed with the letter of _____.
- ☒ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. 1 - 11, filed with the letter of 11.01.1999,
 Nos. _____, filed with the letter of _____.
- ☒ the drawings, sheets/fig 3B, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig 1, 2A, 2B, 3A, filed with the letter of 11.01.1999,
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI97/00559

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-11</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-11</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-11</u>	YES
	Claims		NO

2. Citations and explanations

The invention relates to a method and an arrangement for location updating of a wireless terminal in a communications system, and a private branch exchange.

The method (claim 1) and arrangement (claim 10) include a terminal (TE) sending a location updating message to a private branch exchange (PBX). The private branch exchange (PBX) sends a call set-up message to an exchange (EXC) including location information and the identity of the terminal. The exchange (EXC) sends location information and the identity of the terminal to a node (SCP) in an intelligent network. The node (SCP) adds the location information and the identity of the terminal to a subscriber number (MSISDN).

The private branch exchange (claim 8) has means for sending location information (EI) and identity of a terminal to an exchange. The private branch exchange can be connected to a service switching point and to base stations. The location information (EI) is formatted so that the Service Switching Point re-sends said location information to said service control point.

WO 96/18273 A1, (D1), cited in the International Search Report, shows a radiocommunication system. It includes local exchanges (15, 17 in fig. 1), base stations (16, 18) and a service control point (12). A visited local exchange (15) has means for sending location information and identity to a home local exchange (17) (page 9, line 27-32) during a location updating performed by a terminal (page 9, line 17-21).

WO, 93/25050 A1, (D2), cited in the International Search Report, discloses a method for location updating in a cellular radio network. However, the location information provision is not managed in the same way as in the invention, defined by claims 1-11.

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI97/00559

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

WO, 95/33348 A1, (D3), cited in the International Search Report, presents an arrangement to interconnecting two communication systems. Location updating is mentioned briefly in D3.

The invention, defined by claims 1-11, is considered to be new and to differ substantially from the documents cited in the International Search Report, i.e. it discloses an inventive step. It is also considered to have industrial applicability.

CLAIMS

1. Method for location updating of a wireless terminal (TE) in a communications system comprising a number of Private Branch Exchanges (HPBX, VPBX) and at least one telephone exchange (EXC) and being connected to a Public Integrated Services Network (PISN) and an intelligent network;

in which method the terminal (TE) sends (2A-1, 2B-1) in connection with a call setup a location updating message to a PBX and the PBX sends (2A-2, 2B-2) a call setup message to the exchange (EXC);

10 **characterized** in that, additionally in the method,

- the PBX adds (2A-2, 2B-2) the location information and the identity of the terminal (TE) to the call setup message;

- the EXC sends a node (SCP) of the intelligent network a service request (2A-3, 2B-3), including the location information and the identity of the terminal (TE); and

15 - the node (SCP) of the intelligent network adds the location information of the terminal (TE) to the subscriber number, preferably to the MSISDN number, of said terminal (TE).

2. Method according to claim 1, **characterized** in that in case of an incoming call (3A-1) to the terminal (TE):

- the exchange (EXC) sends (3A-2) the node (SCP) of the intelligent network a service request comprising the subscriber number, preferably the MSISDN number, of the terminal (TE);

25 - the node (SCP) of the intelligent network returns (3A-3) the location information of the terminal (TE) to the exchange (EXC);

- the exchange (EXC) establishes (3A-4) a connection with the PBX indicated by the location information of the terminal (TE), which PBX sets up (3A-5) a call with said terminal (TE).

3. Method according to claim 1 or 2, **characterized** in that at least one Home Private Branch Exchange (HPBX) is allocated to each terminal (TE), which HPBX notices in case of an internal call that both the calling and the called subscriber are in the area of the same PBX, and in this case the HPBX sets up a call without any service request to the intelligent network.

4. Method according to any one of the claims 1 to 3, **characterized** in that the PBX (HPBX, VPBX) reserves for the terminal (TE) a

roaming number (CLG#ROAM#) used as location information of the terminal (TE).

5 5. Method according to claim 4, **characterized** in that a fixed area from a number space of the PBX (HPBX, VPBX) in question is reserved for roaming numbers (CLG#ROAM#) in the numbering plan.

6. Method according to any one of the claims 1 to 5, **characterized** in that the terminal (TE) is a terminal of the DECT system and the identity of the terminal (TE) is IPUI or IPEI.

10 7. Method according to claim 6, **characterized** in that the method uses DSS.1 signalling protocol and the location information is positioned in a FACILITY or USER_TO_USER information element.

8. Private Branch Exchange (PBX), comprising means for connection to a Service Switching Point (SSP) of an intelligent network and to base stations (DECT-FP) of a telephone system supporting wireless terminals (TE);

15 **characterized** in that the PBX additionally comprises

- means for indicating location information for a subscriber (TE) of a wireless network; and

20 - means for sending the location information and the identity of the terminal (TE) to an exchange (EXC) in connection with a location updating performed by the terminal (TE).

9. Private Branch Exchange (PBX) according to claim 8, **characterized** in that the location information of a terminal (TE) is a roaming number (CLG#ROAM#), which is preferably reserved from the number space of said PBX.

25 10. Arrangement for location updating of a wireless terminal (TE) in a communications system, the arrangement comprising a number of PBXs (HPBX, VPBX) and being in connection with a Public Integrated Services Network (PISN) and an intelligent network;

30 in which arrangement the terminal (TE) comprises means for sending a location updating message (LOC_UPD_REQ) in connection with a call setup to a PBX and the PBX comprises means for sending a call setup message (SETUP) to an exchange (EXC);

characterized in that additionally

35 - the PBX comprises means for allocating location information to the terminal (TE) of the wireless network;

- the PBX comprises means for adding the location information and the identity of the terminal (TE) to the call setup message (SETUP);

- the exchange (EXC) comprises means for sending the location information and the identity of the terminal (TE) to a node (SCP) of the intelligent network in connection with a service request (INVOKE);

- the node (SCP) of the intelligent network comprises means for adding the location information and the identity of the terminal (TE) to the subscriber number, such as a MSISDN number, of the terminal (TE).

11. Arrangement according to claim 10, **characterized** in that the location information of the terminal (TE) is a roaming number (CLG#ROAM#) allocated by the PBX.

Fig. 1

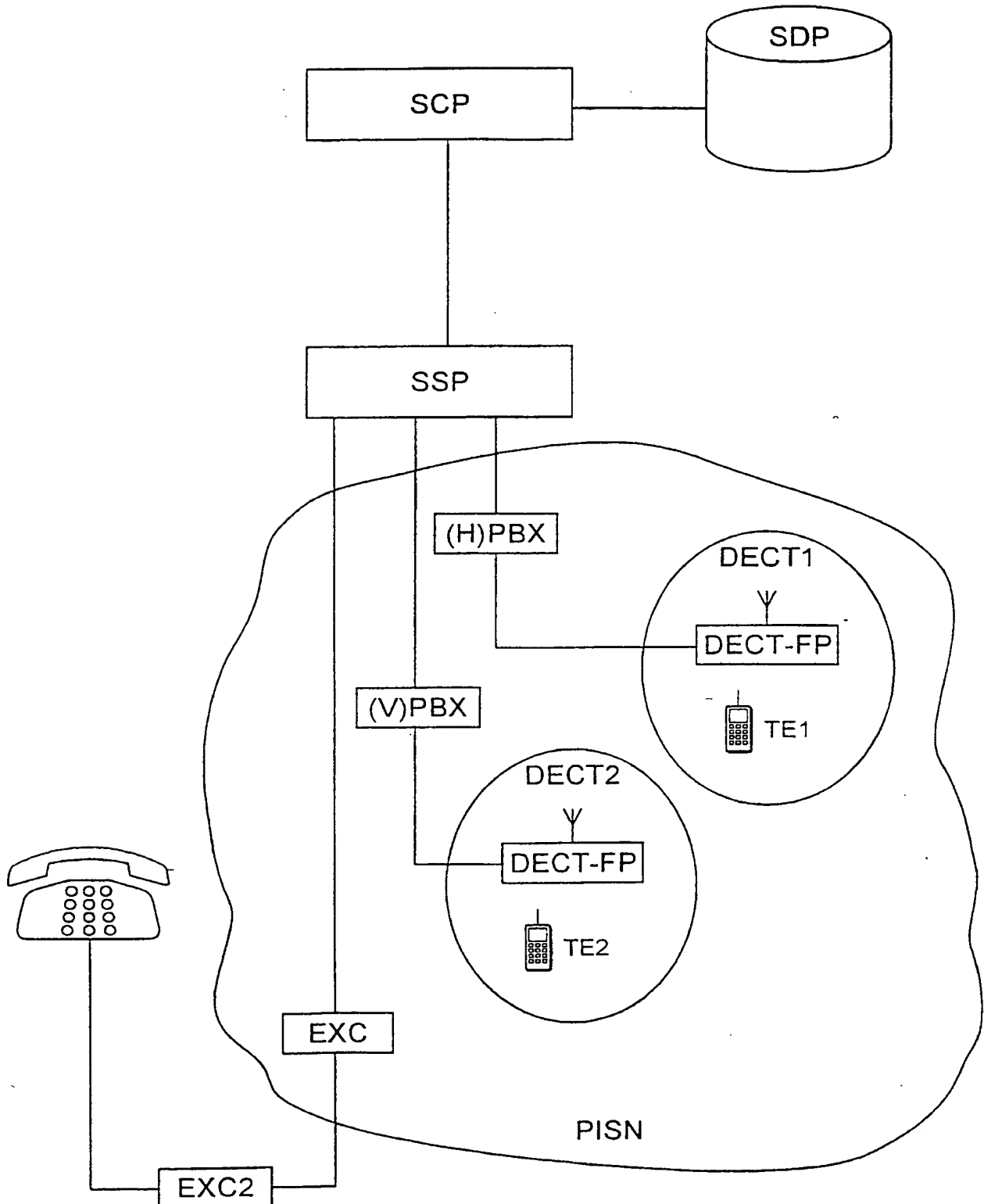


Fig. 2A

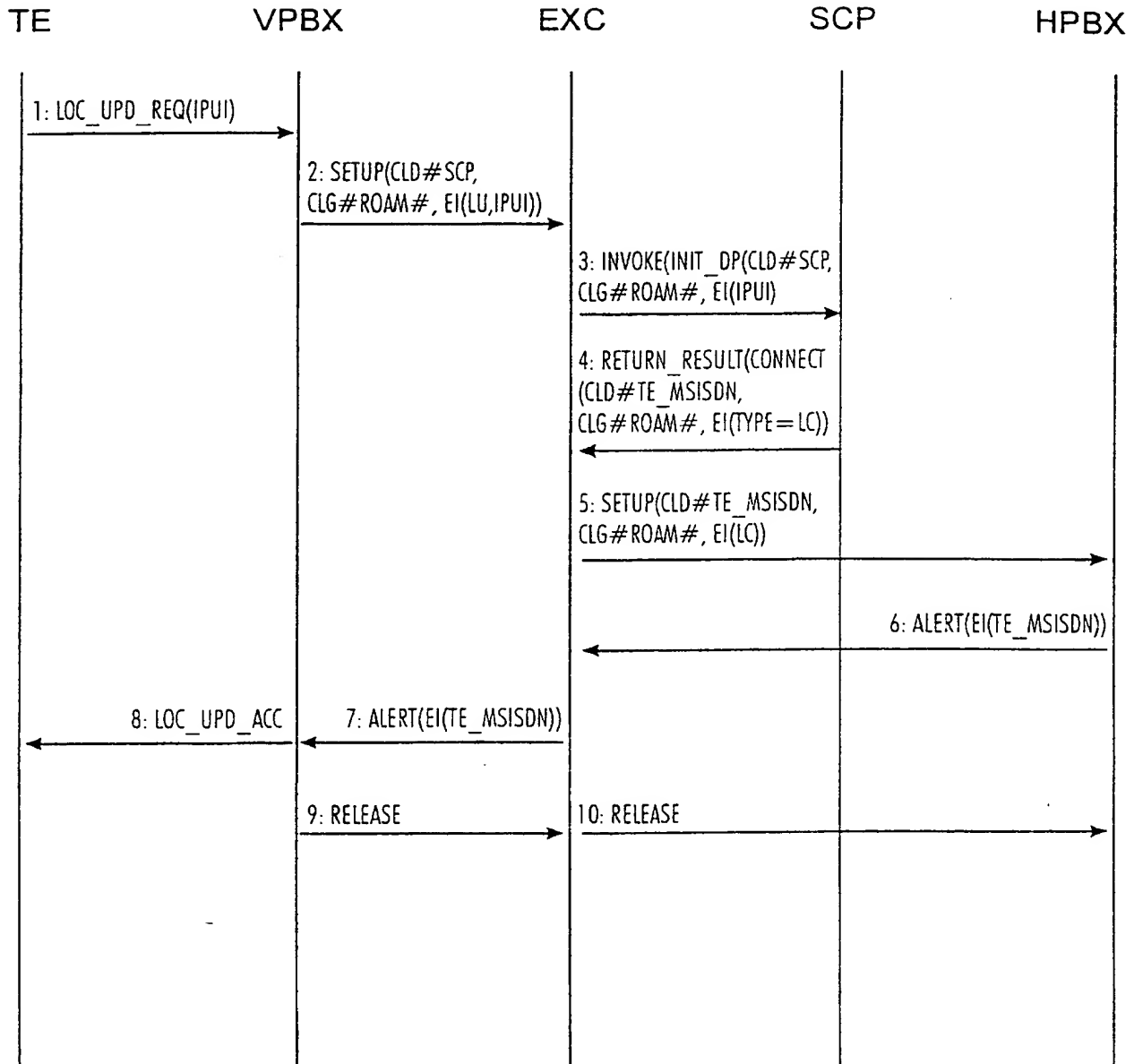


Fig. 2B

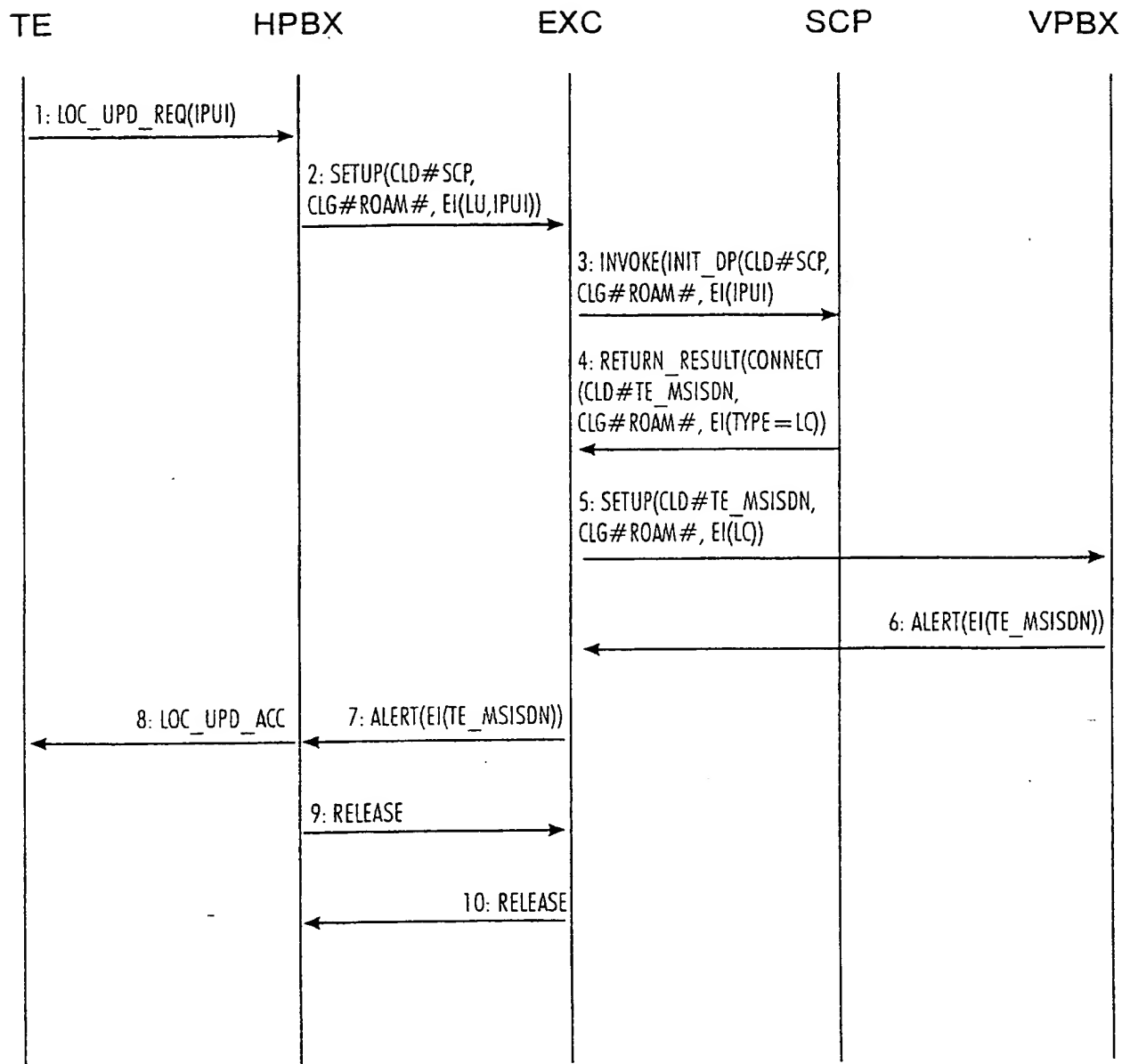
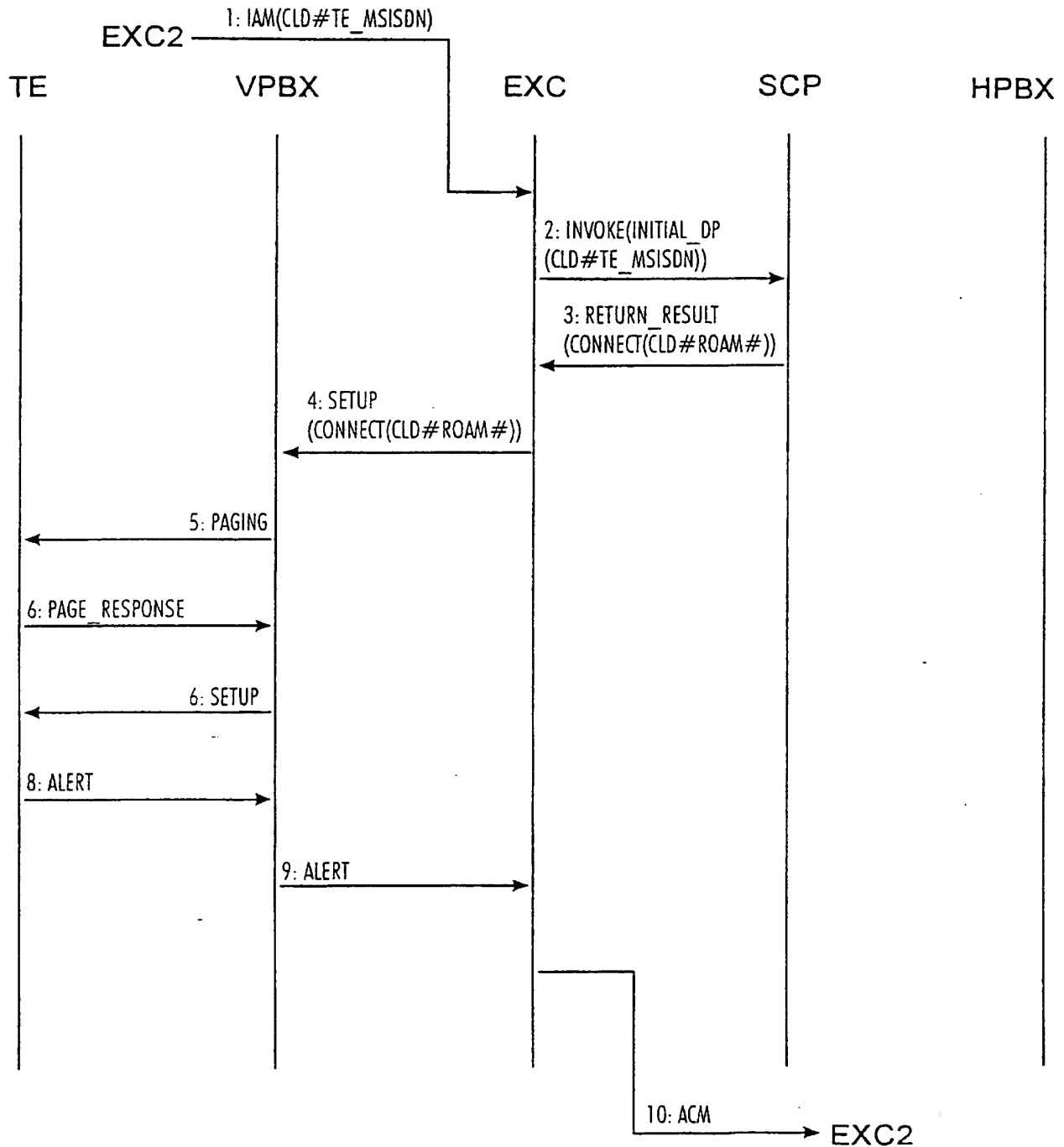


Fig. 3A



PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

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Date of mailing (day/month/year) 18 May 1998 (18.05.98)	
International application No. PCT/FI97/00559	Applicant's or agent's file reference 43215/PCT/ko
International filing date (day/month/year) 18 September 1997 (18.09.97)	Priority date (day/month/year) 19 September 1996 (19.09.96)
Applicant LAHTINEN, Lauri	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
14 April 1998 (14.04.98)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ :

H04Q 7/26

A1

(11) International Publication Number:

WO 98/12886

(43) International Publication Date:

26 March 1998 (26.03.98)

(21) International Application Number: PCT/FI97/00559

(22) International Filing Date: 18 September 1997 (18.09.97)

(30) Priority Data:

963722

19 September 1996 (19.09.96)

FI

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Kurkijoentie 7 B, FIN-02140 Espoo (FI).(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box
148, FIN-00121 Helsinki (FI).(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR,
BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE,
GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
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Published

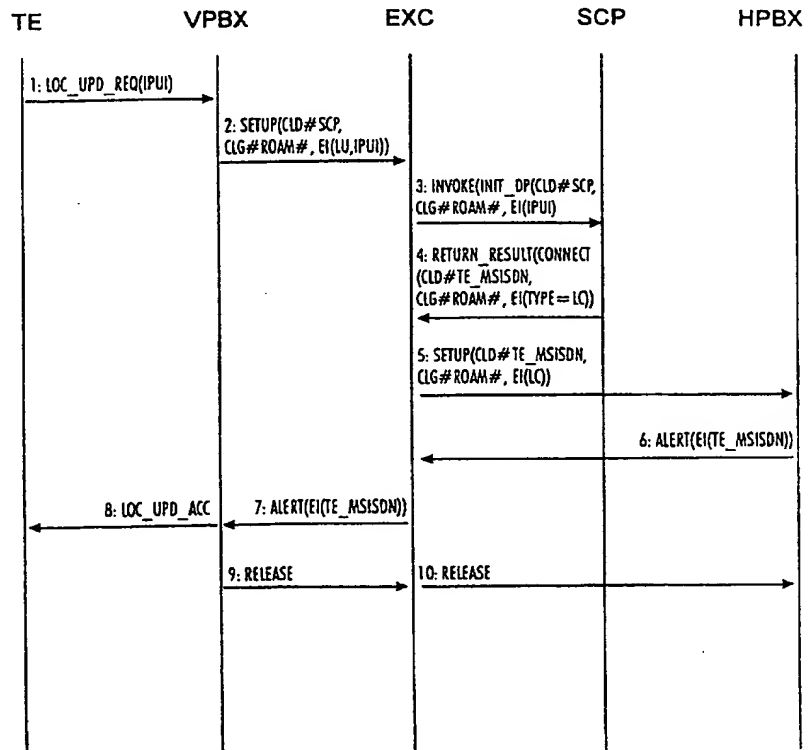
With international search report.

Before the expiration of the time limit for amending the
claims and to be republished in the event of the receipt of
amendments.

(54) Title: LOCATION MANAGEMENT OF A WIRELESS TERMINAL

(57) Abstract

Location data of a subscriber terminal (TE) are maintained by means of intelligent network technique. Signalling between a telephone exchange (EXC) and a PBX is supplemented with extra information including the information on the location of the subscriber TE. A roaming number ROAM# is allocated to a TE moving into the area of a Visited PBX (VPBX). Call setup protocol between the PBX and the EXC is supplemented with an extra packet (EI) supporting the subscriber mobility in such a way that the information on the subscriber's location can be transmitted to a Service Control Point (SCP) of the intelligent network. In connection with location updating, the VPBX informs the intelligent network (SCP) that the TE tries to register to the area of the VPBX. The intelligent network (SCP) checks whether said subscriber has the right to use the services of the VPBX. In case of a call to the TE, the EXC asks the intelligent network (SCP) for the location information of the TE on the basis of the subscriber number of the TE. Subsequently, the EXC establishes a connection with the PBX indicated by the location information, which PBX sets up a call to said TE.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00559

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9325050 A1 (NOKIA TELECOMMUNICATIONS OY), 9 December 1993 (09.12.93), page 1, line 1 - page 2, line 15; page 8, line 17 - page 12, line 13	8
A	--	1-7,9-11
X	WO 9618273 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 13 June 1996 (13.06.96), page 10, line 11 - page 13, line 3	8
A	--	1-7,9-11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search

19 February 1998

Date of mailing of the international search report

20 -02- 1998

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Authorized officer

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Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00559

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9533348 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 7 December 1995 (07.12.95), page 10, line 10 - line 18; page 12, line 8 - page 13, line 15; page 15, line 27 - page 16, line 14, page 17, line 11 - line 25, page 19, line 9 - line 21 -----	1-11

INTERNATIONAL SEARCH REPORT
Information on patent family members

03/02/98

International application No.
PCT/FI 97/00559

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9325050	A1	09/12/93	AU	661775 B	03/08/95
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				EP	0610453 A	17/08/94
				FI	95758 B,C	30/11/95
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				NO	940244 A	24/03/94
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				CA	2207317 A	13/06/96
				EP	0796543 A	24/09/97
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				SE	9404285 A	08/06/96
WO	9533348	A1	07/12/95	AU	2686495 A	21/12/95
				CA	2190257 A	07/12/95
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